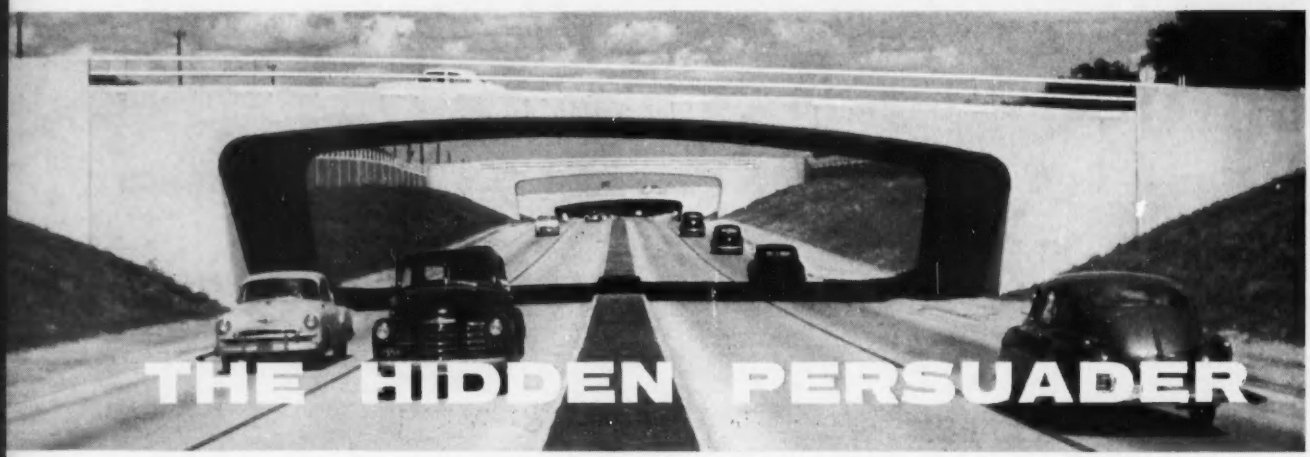
59
MAR
vol. 4
no. 3

concrete construction

ARTICLES



Elsewhere in this issue will be found the last installment of a series of articles discussing the role of ready mixed concrete in the highway program. We think a commendable effort has been made in these articles to deal objectively and realistically with an admittedly complex subject. At the risk of seeming to preempt a right of summation which we have no wish to claim, we'd like to add a brief postscript to the subject.

Important as it is to muster argument and logic and technical data on the side of this much-to-be-desired extension of the use of ready mix, in the final analysis the case can only be argued conclusively by the quality and performance of our industry's product. In less than half a century ready mixed concrete has developed from the bare rudiments of an idea to one of the most widely used of all construction materials by repeatedly demonstrating its ability to match or better the qualities of job-mixed concrete, while offering an impressive number of advantages in terms of economy, convenience and dependability.

We believe that the same factors are at work today to bring about wider use of ready mix in highway and street pavements. This, indeed, is the whole secret of the underlying strength of the ready mixed concrete industry and the reason for its phenomenal growth. For no builder is compelled to buy ready mixed concrete in the sense that he is compelled to buy virtually every other material he uses; in the case of concrete he is always confronted by the alternative possibility of batching and mixing his own materials.

The producer of ready mix is disciplined by this circumstance as is no other manufacturer of building material we know of. Seldom has he been able to rest for long on laurels already won, or relax for even a day his efforts to maintain high standards of quality and service. This industry can survive and prosper only by constantly exceeding the standards of quality and service which its own customers can also achieve.

This is why we look for rapid expansion of the use of ready mix in streets and highways. Logic and argument will undoubtedly help the cause along, but the outstanding performance of our product in this and other fields of application is actually the hidden persuader that makes progress inevitable.

A PRIMER ON VIBRATION

Part 1

Placing low slump concrete is greatly simplified by the correct use of the proper vibratory tools. This is the first installment of a two part article dealing with the fundamentals of vibrating concrete.

THE HIGH STRENGTH CONCRETES, which are called for in most modern structural designs are mainly attainable through the use of low slump mixes. One important consequence of this is that in today's practice stiff mixes are the rule rather than the exception.

The use of structural concrete has grown by leaps and bounds in recent years, and this expansion has inevitably focused increased attention on problems related to the proper handling and placement of stiff mixes. The advent of prestressing and ultimate strength design has further emphasized these problems since greater demands are being placed on the concrete.

Then, too, exposed concrete is gaining popularity with the development of many new surface textures and treatments. This necessitates concrete that is free from honeycombing and other surface defects caused by faulty placement practices.

equipment

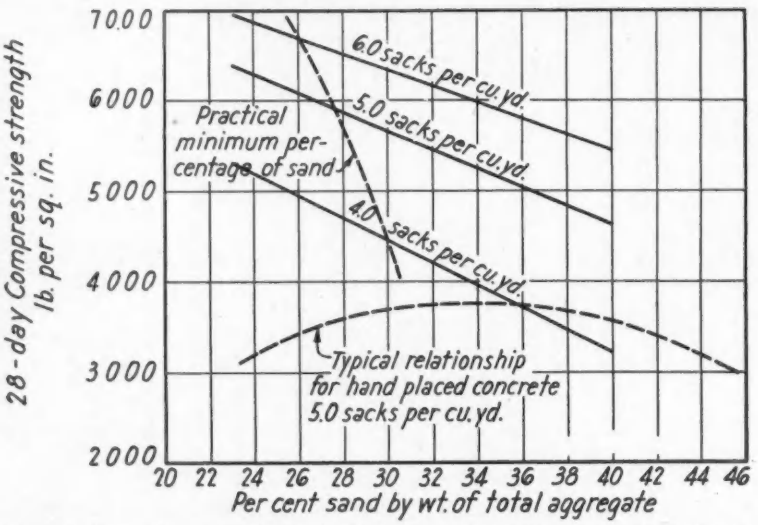
Out of these needs arose the concept of vibration. It was found that vibration, applied internally, simplified the placing of stiff mixes which would otherwise contain voids and have poor bond with the reinforcement. Low slump concrete that would have confounded contractors three decades or so ago can now be placed and consolidated with thoroughness and speed.

An important element in vibration that largely determines the ease and economy of such work is the choice of equipment. This decision will almost always be governed by the nature and scope of the work involved.

power

Vibrators are commonly powered by one of three types of motors—gasoline, pneumatic or electric. Power option costs do not vary materially, and since units of a wide range of sizes and capabilities are manufactured for all three power sources, selection will probably often depend on the type of power that will be available.

Imagine a machine delivering over 10,000 one ton blows in a minute! Vibrators are called upon to perform this work as a matter of daily routine.



Through the employment of vibration it is not unreasonable to expect a reduction in water content of as much as a gallon per sack of cement in most concrete for structures. Within the range of practical mixes, the reduction may amount to 8 or 9 gallons per cubic yard of concrete, with a resulting compressive strength gain of some 1,750 psi. Even greater strength gains may result if less sand is used, as is indicated by the above graph.†

Here a highly portable ¾-horsepower internal vibrator with a head only 1¼ inches in diameter is being used to consolidate low-slump concrete in a prestressed beam.

Such rough service naturally means that vibrators must be carefully constructed of high quality materials. Workmanship and performance records mean a lot when comparing vibrators. It's necessary for contractors to look beyond the price and operating specifications of a unit to determine its true value. Often two vibrators will appear to be alike physically but will differ markedly in cost. Upon closer inspection the two items will often reveal sharp differences in terms of quality of manufacture. A saving in original cost can be offset in short order when maintenance starts rising and breakdowns increase.

efficiency

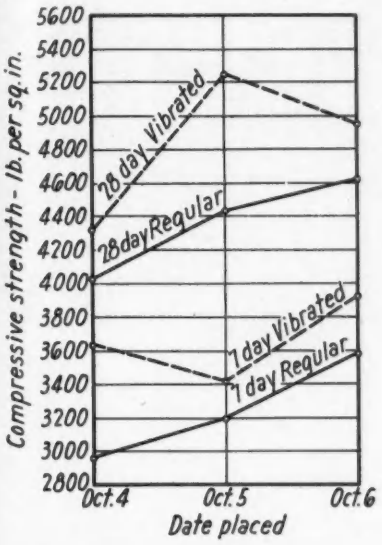
Frequency, amplitude and force are the main functional characteristics of vibrators to consider when selecting such equipment. Their resultant centrifugal force determines the effectiveness of the vibrator in concrete.

As you know, concrete is a mixture of aggregates of widely varying sizes bound together by a cement paste. Aggregate particles, due to their unlike mass or size, have different inertias (resistance to movement). In a stiff, plastic mix it is necessary to vibrate at a rate sufficient to set up movement of the larger aggregate particles. This will cause aggregate movement of greatly varied direction and speed. Such movement results because the particles of lesser size will move at different rates and in several directions. The variety of aggregate shapes will also add to this differential movement. It is this diversity of action in vibrated concrete that works free air in the mix to the surface.

In considering the effectiveness of a particular vibrator its frequency must not be considered alone, but must be properly related to the amplitude (the amount of movement). For example, a very high frequency vibrator with a very low amplitude has a tendency merely to cream the material immediately adjacent to it without causing appreciable movement a short distance away. In the United States today the generally accepted frequency for vibrating concrete is in the 9,000 to 10,000 rpm* range.

Thus, a vibrator must be chosen

*Revolutions per minute in this context indicates one complete cycle of vibration per minute, and is used here to avoid the ambiguity of the term "vibrations per minute."



This graph shows the compressive strength gains in both 7- and 28-day concrete as a result of vibration. The tests were performed on pavement concrete placed on three consecutive days.‡

that operates at a high enough frequency to consolidate the concrete thoroughly with a minimum of labor; but care must be exercised to avoid the high upkeep expense of an underpowered machine.

Amplitude (the side-to-side distance that the head travels in its vibration cycle) is of equal importance to frequency in gaging a machine's effectiveness. Most concerns making vibrators adopt an amplitude for each of their models that best complements the frequency range of the machine; that is, one that will be most effective in consolidating the concrete and yet put the least amount of strain on the workman and the vibrator.

types

Four general types of concrete vibrators are in use today: (1) internal; (2) form; (3) surface; and (4) table. The latter type is not covered in this article since it is largely limited to use by laboratories and manufacturers of small precast products.

Where practical, it is advisable to use internal vibrators. They offer highest efficiency since their output is transmitted directly to the concrete. In addition, internal vibrators place the least amount of strain on formwork. Many models still contain the bulky power source on a base intended for semi-fixed positioning with the power transmitted through a flexible shaft to the head, which is inserted in the concrete. But today there is also a wide choice of ultra-compact machines that contain the motor in the head assembly.

Form vibrators are invaluable for sections that are too deep and narrow or that contain too much reinforcement to vibrate effectively with internal units. Extra care must be exercised in choosing this type since a high force is needed to penetrate through the forms to the concrete. Amplitudes should be minimal to prevent form damage.

Surface vibrators have extended the advantages of vibration to thin, horizontal sections such as roads, floors, driveways and sidewalks. This type is available in a wide variety of models including units to attach to screeds and complete screed units that roll on their own wheels. A complete unit should be heavy and rigid enough to maintain a straight bottom edge and yet be easily portable. It should also be readily adjustable in terms of length and height.

Contractors today have a magnificent array of general purpose and special purpose vibrators from which to choose. General purpose units have the widest field of application and are probably the most practical choice for small contractors who may not wish to invest in several types. Special purpose vibrators can save time, money and headaches for the contractor who has special, recurring problems.

In figuring the number of vibrators for a job, it should be remembered that vibrators are often subjected to rough handling, and by their very nature they are prone to require periodic repair and maintenance. Skimping on the number of vibrators ordered for a job can be false economy since their role in the construction routine is so vital. The picture of a crew standing idle and a lineup of ready mix trucks waiting while the job foreman works frantically to repair an ailing vibrator can be very disheartening.

importance of slump

Vibration makes possible some notable economies in mix design. To achieve the higher strengths now commonly being specified, it has been nec-

An example of the motor-in-head type of vibrator which can readily be operated by one man.

Blade-type vibrator attachments provide effective compaction between closely spaced prestressing cables and other reinforcing steel.

‡From *Vibration for Quality Concrete*, a publication of the Portland Cement Association.

This motor-in-head vibrator operates from any on-the-site 110-volt outlet or from DC generator output. It provides high frequency, low amplitude vibrations in medium or high-slump concrete.

essary to reduce the amount of mix water. It becomes necessary, therefore, to choose between a rich stiff mix or a lean stiff mix.

Rich mixes require an increase in the quantity of sand for handling purposes and consequently an increase in the surface area which the cement paste must cover. This is expensive. If a greater amount of coarse aggregate is used, an increase in strength can be effected without a commensurate rise in concrete cost. Naturally, the resulting mix is harsher but vibration makes it possible to place and consolidate such mixes easily and quickly. Contractors should keep this in mind when ordering ready mix. When a rich high slump concrete is ordered, not only is economy sacrificed but the vibration of such concrete results in segregation and poor wearibility of horizontal concrete surfaces.

Selecting the right slump for any given job will depend on several factors, including vibratory equipment efficiency, depth and width of the section, amount of reinforcement and available handling equipment. Low frequency vibrators and form vibrators often require higher slump concrete than is needed with high frequency internal vibrators. Some manufacturers offer external vibrators with sufficient speeds to be adequate for concrete placement. Heavily reinforced sections make it difficult to penetrate with an internal vibrator and also limit the size of the coarse aggregate. This means a relatively unstable mix and the obligatory use of a less efficient form vibrator. Unusually deep or narrow sections often render vibration uneconomical or impossible except with form vibrators, although some manufacturers offer special internal vibrators for this purpose.

High quality handling equipment should be used for transporting and placing low slump mixes. Chutes should be steeply inclined to mimimize the need for pushing the concrete along by hand.

Vibration thus makes it possible to reduce the amount of cement in a mix without lowering its strength. Compensation for this reduction in cement content is made by using less water. In this manner cement requirements can often be lowered from five to four sacks in a typical mix.

To be concluded in the April issue.

CONCRETE CONSTRUCTION MAGAZINE

P.O. Box 444 Elmhurst, Illinois

ANdover 3-4329 (To Mar. 15, 1959)
TErrace 4-5110 (Mar. 15 and after)

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DUNCAN A. SCOTT & CO.
Los Angeles 57
1901 West 8th St., Dunkirk 8-4151
San Francisco
85 Post Street, Garfield 1-7950

Subscription price: Single copies, $1.00; $5.00 per year (U.S.A.); $10.00 per year (Foreign). Accepted as controlled circulation publication at Chicago, Illinois.

Dodson's Digest

Dial D for Dodson

"I'm in trouble! Can you come over right away?" It was Hal Jasper's voice on the phone—a pitch higher than usual and somewhat frantic. Time: 3:00 o'clock in the morning on a Thursday about a month ago. Mission: Rout me out of bed to help out on a grain-elevator job his contracting firm was pouring.

If I said I'd leaped out of the sack wide awake and alert, eager to meet any challenge, I'd be kidding myself. I only remember stumbling into some clothes and heading the car toward the address he'd stammered out.

When I arrived at the floodlighted job site, it was starting to snow, and I noticed the air had a bite it didn't have the evening before. I saw Hal directing some ready-mix trucks toward a crane, so I hurried over.

"Oh, hello, Dod," he said absently, "have you seen my——"

"Don't tell me. I know your problem," I interrupted reassuringly. "It's a continuous pour and the temperature dropped on you. You'd better call the ready-mix company and tell them to add Calcium Chloride right away. It'll speed setting, cut your protection period in half! More important, your concrete will flow faster, fill the forms quicker, and——"

"I know," he broke in edgily. "Called 'em hours ago. You know I'm sold on Calcium Chloride."

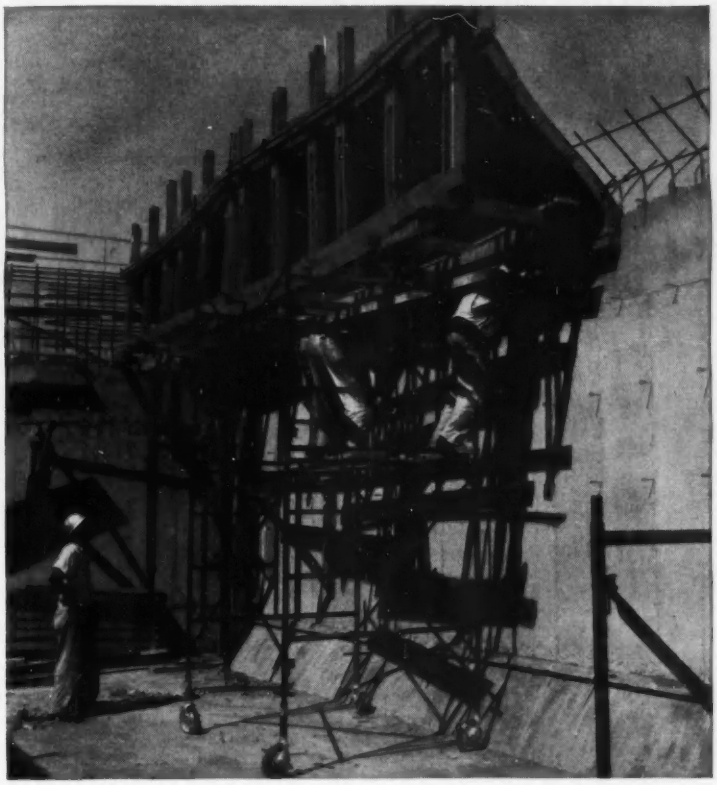
I was flabbergasted. "Then why did you arouse me from a sound sleep in the middle of the night when——"

"YOU?" Hal's face broke into a sheepish grin. "I've been waiting for my day foreman. Must have misdialed. You see, the night man hurt his foot, and——"

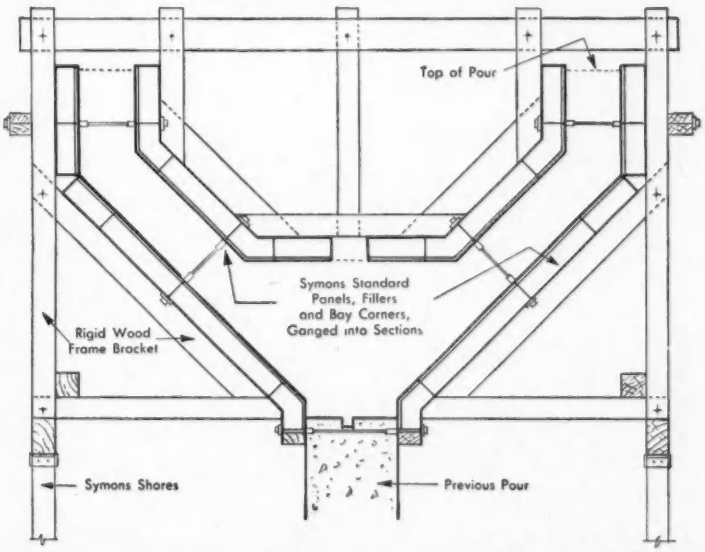
—L. D. Dodson

P.S. If you'd like to pore over some enlightening facts on improving concrete, write for our booklet, "How To Make Better Concrete Products and Ready Mix." *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Offices in principal cities.*

Gang Forming Licks "Y" Wall Problem



Workmen on Columbus sewage extension job are putting a gang forming section into place for a pour with aid of rolling scaffolding. Ganged section was 16 feet long.



Typical "Y" wall section in which Symons standard panels, fillers, inside and outside bay corners, which were eight feet long, were ganged in 16 foot sections.

Pays Off in Quality Pours, Speed and Reduced Costs

2,665 lineal feet of "Y" walls and half "Y" walls, with 16'9" high walls on a tank addition to a sewage treatment plant—that was the pouring problem faced by contractors, Wander & Mason of Worthington, Ohio.

They solved the problem by pouring the walls in three lifts with the forms ganged for the final "Y" and half "Y" pours. The tank was 485 feet long and 120 feet wide with five 485 foot "Y" walls in the tank.

On the "Y" walls Symons standard panels, fillers, inside and outside bay corners, which were eight feet long, were ganged in 16 foot sections and handled either by crane or rolling scaffolding. Ganging the forms licked the problem. Quality of the pour was excellent. Speed of erecting and stripping reduced cost appreciably. One 16-foot outside section was stripped, moved to the next wall section and reset by three men in 20 minutes.

Rigid frames to brace the ganged forms were designed by Symons engineers and representative Rapid Construction Equipment, Inc., and built on the job site by the contractor. The outside "Y" wall form section was held to the previous pour by anchor bolts and supported by Symons Shores spaced four feet on center at the outer extremities of the bracket. Additional shores were used beneath the bracket to supplement the anchor bolts near the main wall.

Inside forms were completely ganged and before pouring were bolted to the outer vertical members of the outside frame. This method held the inside forms in position along with the assistance of the coil ties which were spaced on four foot centers. This prevented the inside from floating while pouring.

Symons Forms, Shores and Column Clamps can be rented with purchase option. Information on Symons products available upon request.

Symons

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BY ALBERT B. TIMMS*

PART 3

SUITABILITY OF TRUCK-MIXED CONCRETE FOR PAVEMENTS

FILE: Paving

THIS THIRD ARTICLE on the use of truck-mixed concrete for pavement construction deals with approved discharge procedures, and special problems of hot and cold weather concreting. A summary of recommended practices is also included.

In the second part of this discussion, the necessary steps and precautions required to produce uniform concrete were described. Even with the most careful attention to such production details, improper discharge methods may lose part of the advantages gained by meticulous controls of batching, or appropriate speed of mixer, and duration of mixing.

discharge problems

It is always desirable to take measures to prevent segregation from taking place at any stage in the preparation, handling or placement of concrete. To the extent that segregation may occur more readily in low slump concrete, highway paving projects probably demand more careful attention to this problem, but happily there are a number of specific precautions which can be taken.

Relatively small discharge streams should be avoided, and the concrete should be discharged through an unrestricted opening at sufficient speed to keep the chute fairly full. There should be a baffle or some other segregation inhibiting device (such as a section of "down pipe") at the end of the chute.

If gravity flow is to be depended upon (as generally will be the case) the chute should be steep. However, a flat chute is entirely satisfactory if the concrete is pushed or pulled (with hoes, for example) along the chute. Well worth exploration is the possibility of using a short section of belt conveyor to replace the chute—a method which has already been used with good success for handling concrete in some precasting yards (see cut). This type of auxiliary handling equipment could be driven either by means of a power take-off or by an electrical motor.

One of the problems is how to bring the truck mixer or agitator to a location where it can discharge its con-

*Consulting engineer on concrete problems. Formerly assistant manager, Research Laboratory of the Portland Cement Association, and more recently Head of the Concrete and Miscellaneous Unit of the Physical Research Branch of the Federal Bureau of Public Roads.

tents onto the subgrade. Circumstances usually make it undesirable for the mixer to travel over the subgrade. Most often it must be brought along side of the forms, either on the shoulder or on a slab already in place.

If low-slump concrete is discharged close to one side of the forms, it is not readily handled by the commonly used pavement spreaders. Distributing this large volume of stiff concrete rapidly is difficult because no completely satisfactory mechanical spreader is available for general use. Two methods of solving this problem have been suggested: (1) by installing a self-moving hopper on one side of the forms with a screw-type distributor or belt conveyor—the assembly to be of such size that it will take the unrestricted discharge of the truck mixer; and (2) by the use of a bottom dump bucket traveling on a movable boom similar to that used on a paver. The objections to this alternate method are that it would involve a sizeable investment in equipment and men and that it would require several unloadings of the dump bucket to empty the truck mixer.

The usual method of supplementing the present type of pavement spreader with hand shoveling is neither economical or satisfactory. Equipment manufacturers have already designed and developed some suitable equipment to receive and spread truck mixed concrete, and there is certain to be far more activity along this line in the years just ahead.

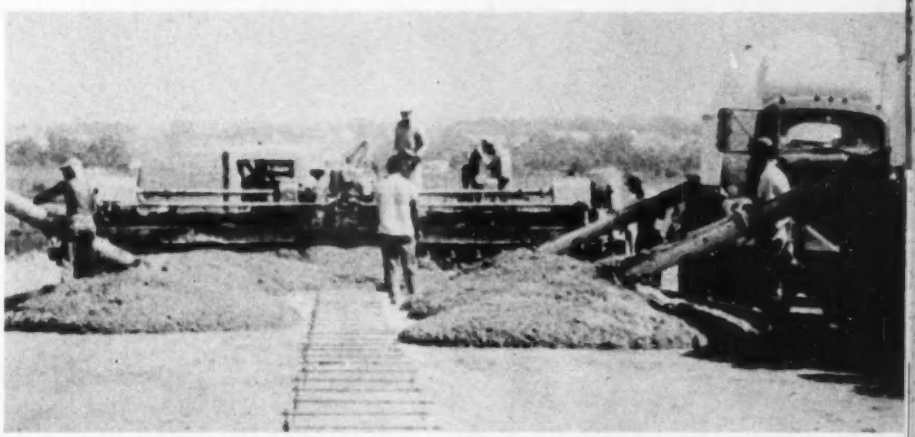
cold weather concreting

Contractors usually place concrete pavements only when the temperature is 50 degrees F. and rising. At that temperature certain precautions must be observed. The concrete as delivered to the site should be brought to a temperature between 50 and 60 degrees.* Sometimes this can be done by heating only the water. The aggregate used should never contain frozen lumps as there is a danger that such frozen inclusions may not be thawed and broken up in the mixing action.

The batching plant must have the facilities to deliver warm concrete to the trucks. Steam boilers and adequate hot water are needed as well as means for heating the aggregates in storage.

(MORE)

*More and more concrete men now agree that the lower the temperature (comfortably above freezing, of course) at which concrete hardens, the better its quality. For this reason the ACI Recommended Practice for Winter Concreting specifically excludes any recommendation of a maximum allowable temperature for freshly mixed concrete in cold weather.



These two photographs show ready mixed concrete being supplied for an important highway paving project in Nebraska. In a number of states the use of ready mixed concrete is already well established.

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The boiler for heating the water should be large enough that appreciable temperature fluctuations from batch to batch are avoided.

In using heated materials, however, care must be taken to prevent flash set in the truck mixers, especially when the water or aggregates are heated excessively. The loading sequence should be such that the cement does not come in direct contact with the heated materials; to guard against this, the cement should be added last, rather than in the usually recommended ribbon loading.

Preparations that are claimed to lower the freezing point of concrete are not considered satisfactory and most specifications forbid their use. Sometimes two percent of calcium chloride (by weight of the cement) is permitted in order to accelerate the hardening action so that the 28-day design strength can be reached at earlier ages. That amount of calcium chloride does not noticeably reduce the freezing point of water.

The wide availability of ready mixed concrete has actually been an important factor in extending the season for all types of concrete construction work, including street and highway paving. The production of heated concrete is today a routine matter for any well-equipped batching plant, and of course the facilities for this purpose are always available on a stand-by basis in case of sudden temperature drops. There is adequate evidence that concrete can be hauled for considerable distances without significant loss of temperature.

hot weather concreting

A phase of concrete making that has often been neglected is the need for special precautions when concreting in very hot weather. There is a wealth of information to show that concrete mixed and placed at temperatures above 100 degrees has inferior qualities as compared to that placed at 50 to 80 degrees. The huge surface area of pavement exposed to the elements makes it extremely important to use effective methods of protecting the concrete.

There are a number of ways in which the truck mixer operator can help keep down the temperature of the newly placed concrete. He should avoid over-long mixing at speeds of 7 to 12 rpm because of the heat developed in grinding the materials and the loss of workability due to the water being absorbed by the fines from the grinding section. Cold mixing water should be used if available. At the batching plant, he can protect the aggregate bins and stock piles from the direct rays of the sun and cool them by sprinkling the stock piles with water at night. It would also be desirable to paint the drums of the mixers white or some other light reflecting color. Exposure of the mixers to the hot sun while waiting to be unloaded should be kept to the minimum.

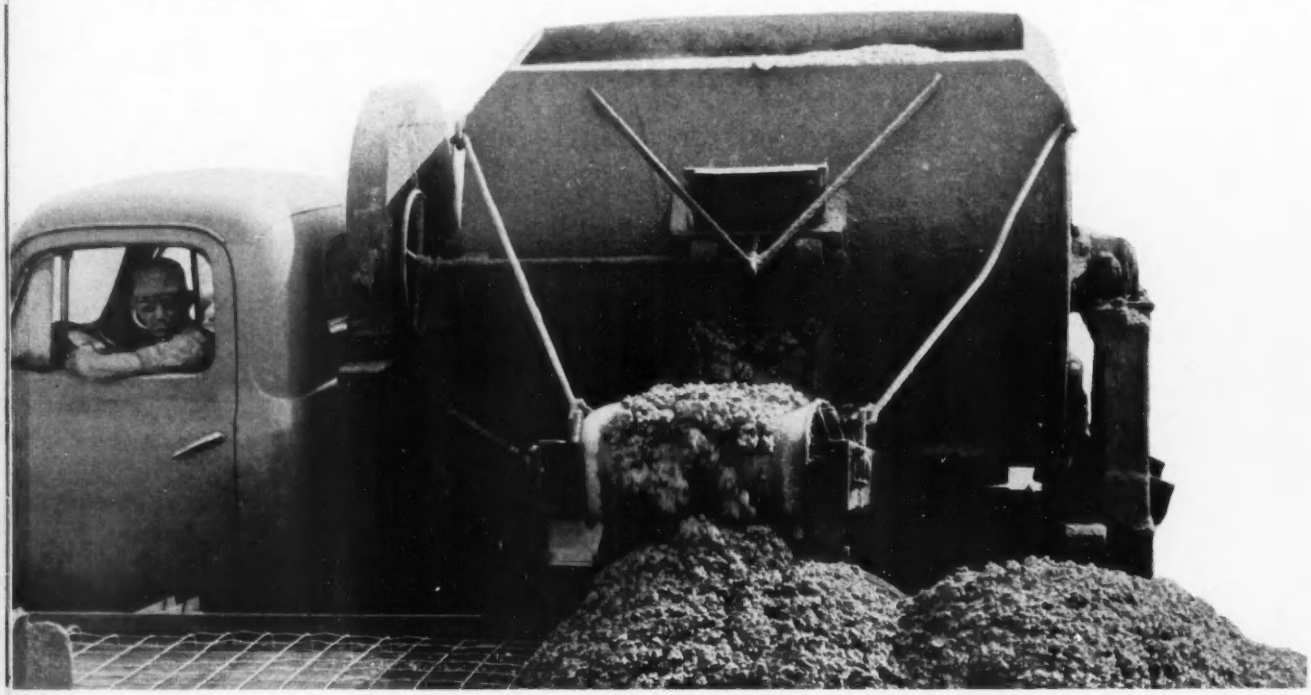
When the cement is hot, care must be used in batching to prevent the cement from being dampened by even a small amount of water before it is dispersed among the other materials. If this should happen, it may set and cause cement balls to form.

A relatively new feature in hot weather concreting is the use of retarders. These admixtures slow up the hardening rate and the concrete develops less heat of hydration. While their use is not common in truck-mixed concrete, it may well be that a retarder would be of considerable benefit in producing uniform concrete in hot weather.

records and communication

A record of the weights of materials going into each batch is desir-

Here a powered belt conveyor is being used successfully to remove ready mixed concrete from a truck to a casting bed for prestressed concrete. A variation of this technique would encourage wider use of ready mix in highway paving.



able. A certified copy of this record should be delivered with each truck load of concrete to the paving inspector. This record should also be stamped with the time the load leaves the batching plant and show the number of revolutions of the mixer drum at that time.

It is very important to have communication between the project and the batching plant. If the haul is long, it will be desirable to have two-way radio communication between the dispatching office and the individual trucks. In case of breakdown or delay at the job site, trucks on the way to the project could then be shunted to other work.

conclusion

Tests and observations, in general, have shown that pavement type concrete of uniform consistency as measured by slump tests (less than 2 inches) can be produced readily in truck mixers within the usual time limits. There should be strict adherence to the sound practices which have been set forth in this series of articles. These rules have been summarized in large type below in the hope that readers will file them for future reference. END

Radio communication is desirable between truck mixers and batching plants. The operator of this radio-dispatched truck is in constant communication with his superiors.

Some Recommendations for the Use of Truck Mixed Concrete in Paving

1. Plant facilities must be adapted to meet State or municipal requirements so that:
   (a) Batching is accurate.
   (b) Adequate storage is provided for cement.
   (c) Aggregate is of a uniform size, grading, and moisture content and can be maintained with a minimum of variation from batch to batch.
   (d) Mixing water is accurately measured and compensation made for moisture in the aggregate.

2. The truck mixers must be in good mechanical condition.

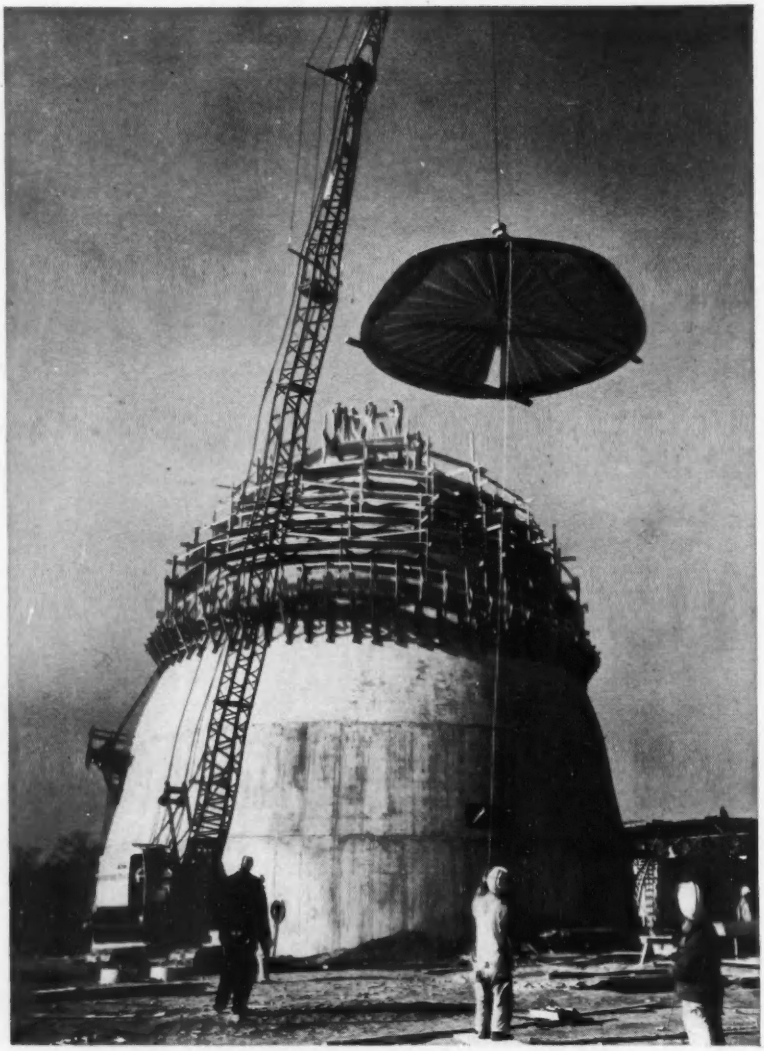
3. Ribbon loading including water should be used whenever possible or else the water should be added to the drum first.

4. A minimum of 75 and a maximum of 150 revolutions of the mixer drum at a speed of 7 to 12 rpm should be used, with an additional 150 revolutions permissible at agitator speed (2 to 6 rpm). Both rate and number of revolutions of the drum should be constant for successive batches. Mixers should be equipped with revolution counters.

5. Segregation of the ingredients in the concrete should be avoided by discharging the mixer at full drum speed with unrestricted opening, and with a nearly vertical drop onto the subgrade.

6. When hot or cold weather prevails, the necessary precautions for obtaining good concrete should be followed.

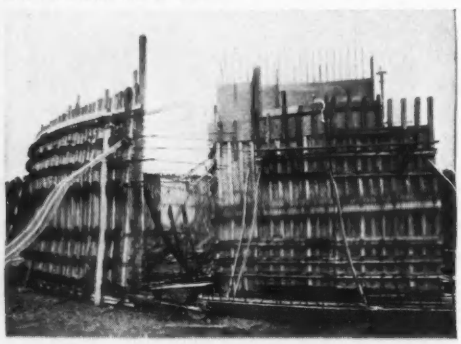
7. The operator should be prepared to furnish records certifying to the quantities in each truck load, time of leaving the batching plant, and the number of revolutions of the mixer drum at the time the mixer leaves the plant.



CROWNING THE BEEHIVE: Crane places cap form on dome enclosing atomic research reactor built for AMF Atomics (division of American Machine & Foundry Company). Skidmore, Owings & Merrill, architects; Severud, Elstad & Krueger, structural engineers; Turner Construction Company, contractor. All are New York City firms.

HEAVY CONCRETE REACTOR CORE: Circular hole in reactor is one of the beam tubes for carrying radiation. In dome, above, is revolving 12-ton crane.

FIRST LIFT progresses simultaneously on reactor and dome walls. Because of the hard to handle heavy concrete, reactor wall forms required double 4" x 4" walers and ½" bolts for tie-rods.



Atomic reactor enclosed with 235 lb. concrete

HEAVY CONCRETE, requiring double-strength forms and hardware, is one of the unusual features of this pool-type atomic research reactor, near Princeton University, N. J. The lower 12′ of the pool has walls up to 9′ thick, of 235 lb. per cu. ft. magnetite concrete. This special mix was also used in the "hot cells" of the adjoining lab. The 3′ thick doors of these cells are filled with 300 lb. per cu. ft. concrete obtained by using ferro-phosphorus. Each door weighs 17 tons.

To prevent radiation hazards, the reactor is further enclosed in an airtight, beehive-shaped dome of concrete, 87′ in diameter and 87′ high. For the first 27′ its walls are 12″ thick. This reduces to 8″ for the next 21′. The remaining height is a 3″ thick Gunited crown. Walls were poured in 3 lifts and, because of the shrinkage problem, only one-third of the circumference of each lift was poured at a time. Ingeniously designed forms were reused, with modifications, for all wall pours.

All concrete, including the special 235 and 300 lb. material, was ready-mixed. Proper processing and deliveries that met varying pouring schedules were assured by using truck mixers of certified design, capacity, mixing speed and water control accuracy.

In this photograph of the recently completed Dallas Memorial Auditorium the parking lot is on the left, the arena in the center, and the theater building on the right. In the background is the Dallas downtown area.

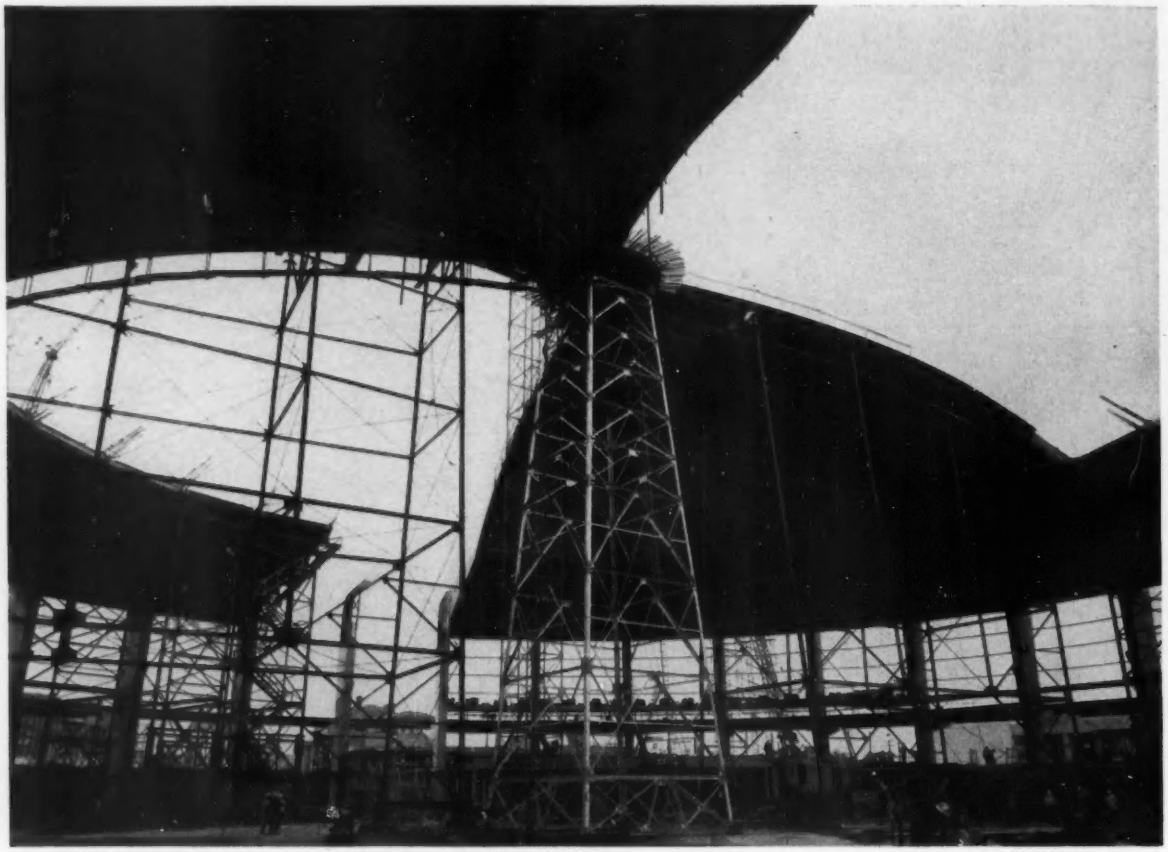
THE DALLAS AUDITORIUM

It's big, like almost everything else in Texas, but the designers and builders also managed to incorporate some fine concepts in the utilization of reinforced concrete.

IN TEXAS they like their buildings big. And Dallas' magnificent new Memorial Auditorium is one of the most spectacular big buildings in Texas. This imposing $8-million reinforced concrete structure, completed last fall, strengthens the city's claim as a convention center. It can house meetings, exhibitions, operas, circuses and sports events in air-conditioned comfort.

The project is really two buildings, set on 23 acres in the Dallas downtown area. The circular arena, which has permanent seating facilities for 10,000 people, has a 300-foot diameter clear area. It is joined by passageways to a smaller, oblong theater building with space for smaller meetings and exhibits. The architects nested the buildings into the rolling site, so that trucks carrying exhibit equipment have easy access to all three levels. A 1000-car parking area surrounds the auditorium, and a 200-foot long covered walkway shelters pedestrians as they approach it.

The main arena boasts several innovations in design and construction. Reinforced concrete was chosen as the structural material because estimates indicated it was most economical, required the least maintenance, and offered a heavier roof mass, an important acoustical consideration. Complex in conception, but simplicity itself in design, the arena was built with reusable



An ordinary oil well derrick was used to support the 22-foot diameter roof cap during construction. The scaffolding and formwork to either side of the derrick support one pair of pie-shaped roof sections during pouring operations. Other sections which have cured balance one another.

forms for the sectioned dome, for the cantilevers that support it, and for the permanent grandstand. Repeated use of these forms reduced the total cost to about half of that estimated for a building with a full concrete or structural steel dome.

With this type of design, coordination was the largest single construction problem. Sequence work was essential; each operation had to be smoothly completed before the next could begin. That the project was such a success reflects credit on the architects, the engineers, and the contractors.

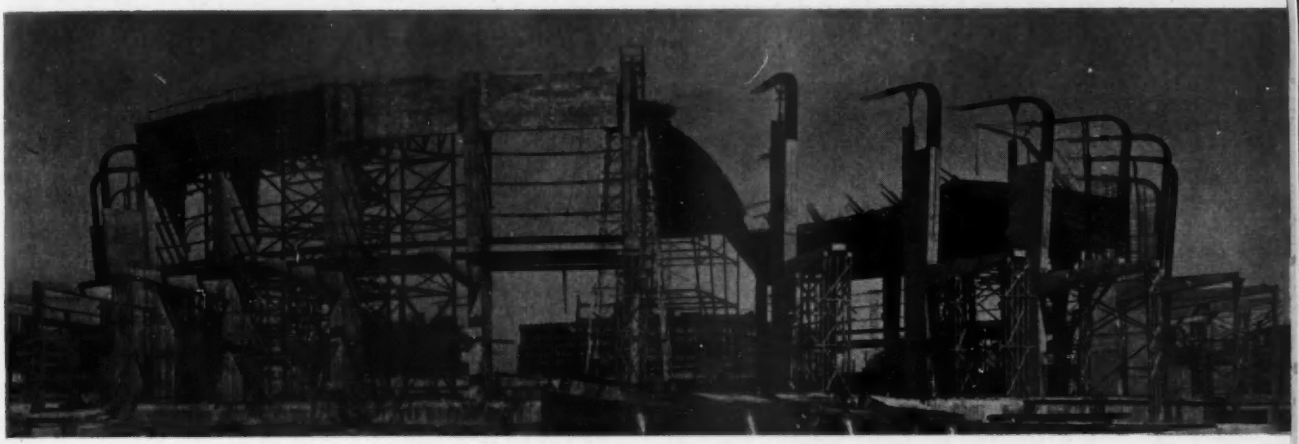
The dome was cast in 33 sections —a ring of 16 trapezoids surrounding 16 pie-shaped segments, which connect with a 22-foot diameter center plate—and supported on 32 cantilevers, each cast in three parts. The sections of the dome were poured in opposing pairs which acted as self-supported arch units. This made it possible to remove the forms and use them for the next pair of sections.

Each segment of the dome, the cantilevers and the vertical legs are completely separated down to the level of the exterior canopies of the arena, except for the central plate at the top of the dome. This separation prevents ring stresses due to volumetric changes, and deflections of the bent under external loads.

The forms for the columns were made of steel, since it was easy to set and adjust to the required camber settings. Steel channels and angles were used for the frame of the forms, and 3/16-inch plate formed the facing. The frame columns were made in three sections. The first went from the footing base to the first floor. The second included a 25-foot cantilevered canopy beam extending outward, and contained No. 11 bars that extended 32 feet above the top of the form. The contractor prefabricated sections of the reinforcement on the ground and had them lifted in place and guyed while permanent supports were placed. The third section of the column was the topmost vertical form. Starting at the bottom of this form, alternate columns were split into two columns. This one-inch split separated the cantilever frames and continued to the top of the roof as the dividing line between the sections.

Each cantilever form was made in two traveling units which were bolted into position to form a full cantilever rib in the center and one split rib on each of the two outside edges of the form. The forms were moved by lowering them and rolling them toward the center of the building. All roof forms had flanged wheels rolling on rails. It took a full day to prepare to move them; putting them into position required another day.

Since the roof was designed for casting in separate sections, the forms had to be cambered to compensate for



This view from the parking area, taken during construction, shows the reinforcing steel for the 45-foot concrete beams that cantilever outward from the columns to support the canopy at the seating level.

anticipated deflections. Vertical cambering was necessary because of the dead load of the cantilever, because of the cambering of adjacent cantilevered sections above previously cast sections, and because of the load of the arched roof resting on the end of the cantilever. Horizontal cambering was required because of the thrust of the arched roof. The forms were equipped with shim plates for accurate setting, to compensate for the setting of cambered forms against previously cast sections.

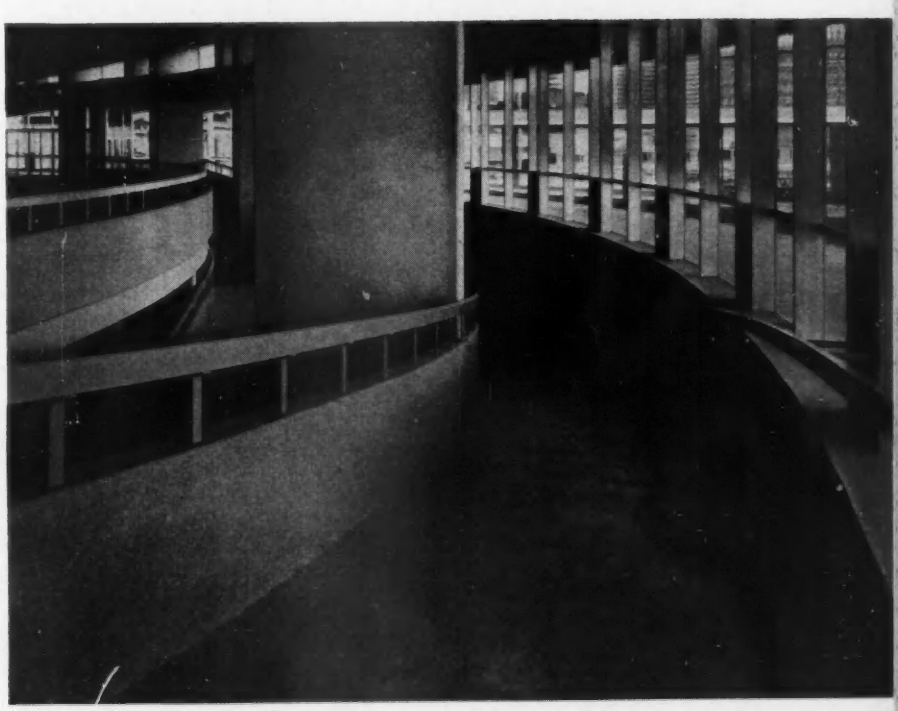
The roofcap was placed before the first opposing set of arched pie-shaped units. It had to carry almost the entire roof before it was completely covered. The cap was supported by a typical Texas oil derrick, which was less expensive to buy than a form would have been to build. It was fitted with sand jacks for lowering. The cap was set with dowels extended and construction keys to receive the arch sections.

When the arch sections were three-quarters completed, the contractor began erecting structural steel under the roof to support press boxes and mechanical and electrical equipment. After the traveling roof forms were cleared from the inside of the building, traveling wooden forms for the loge seating, balcony seating, and second floor were brought in. The beams supporting the balcony slab were designed to run peripherally so that they wouldn't interfere with the moving formwork. Specially designed riser supports were used to hold the balcony risers to line and grade.

All the concrete for the outside of the building and under the roof was placed using cranes with a bucket mounted at the end of the crane boom. Almost everything was too high or too heavy to be hauled by ramps and towers. The central plate at the top of the roof was cast using a construction tower with a hopper under it. Concrete for the arch sections was raised on this tower to the working platform and deposited in buggies. The buggies were moved out over runways supported off the rolling steel forms and the concrete was distributed by a hopper and chute system. More than 30,000 cubic yards of concrete was used in the entire project.

George L. Dahl, Architects and Engineers, of Dallas, designed the auditorium. Ammann and Whitney were consulting engineers. R. P. Farnsworth & Company was the general contractor for the job. END

This is a typical concourse in the arena. The ramps lead from floor to floor, making it easy to move equipment in the building. The cantilevered outside canopy shades the tall windows that surround the arena.



An Alabama contracting firm with twenty years' experience as specialists in curb and gutter work tells how . . .

STEEL FORMS CUT COSTS IN CONCRETE CURB WORK

AFTER MANY MILES of concrete curb work, the Jackson Concrete Company of Gadsden, Alabama, has gained some pretty valuable know-how in saving time and money and in keeping down the size of the work crew in a type of construction that is ordinarily quite costly.

Basic to the operation, say the owners of the company, are good prefabricated steel forms. Without these, they claim, no contractor is in a position to compete for curb work.

There are several features which a contractor should look for in curb and gutter forms. First, the forms should be sturdy enough to take the abuse which workmen will give them. At the same time they should be light enough so that they can be transported in a small pickup rather than a large truck. They should, of course, also be easy to set and strip. Steel forms meet all these requirements say the two brothers, A. W. and R. N. Jackson, who own the Jackson Concrete Company. In addition, steel forms can be used over and over again and have a life expectancy of many years. For example, on a recent job the Jackson Company used 3,000 feet of steel forms that were over ten years old.

Another economy employed by the

Jackson Company in curb and gutter construction is the use of salvage sections of damaged steel forms. This was done on one job reported by them that involved some 200,000 lineal feet of curb and gutter, with approximately 1,500 driveway openings to be formed and poured. Since all their standard forms are 10 feet long, they were able to cut and use a number of sections from 1 foot in length up to 9 feet from those that had been damaged in handling over the years. Thus they were able to use steel right up to the driveway opening without having to bring new forms onto the job.

Along with the use of steel forms goes a specialized work procedure which the Jackson brothers describe as follows:

They grade the street to within 2/10 of a foot of the proper elevation for curbs. Their motor grader man then finishes the job. The form crew, working behind the grader, sets up between 1,800 and 2,000 feet of forms daily.

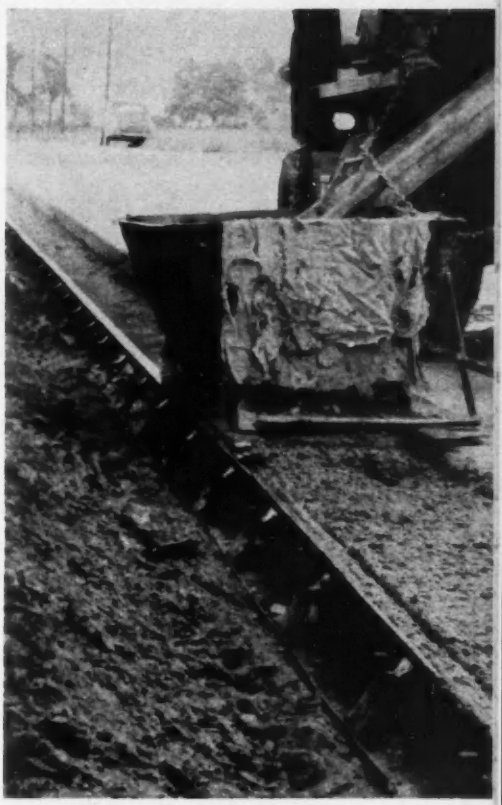
It takes about 8 hours to set the forms. After the pour, concrete sets for 24 hours before stripping, which takes approximately one-third the time of setting.

Because the work procedure is repetitive, little time is lost and the form crew keeps from 300 to 400 feet ahead of the concrete crew all the time.

After twenty years of installing concrete curbing, R. N. Jackson reports that with a crew of 30 men, a labor foreman, a finisher foreman, and himself, the company can complete between 1,500 and 1,800 lineal feet of curbing per day.

This is a record of speed and accomplishment that speaks well for the years of specialized attention that the Jackson brothers have given to both equipment and work procedures. It is a record that should interest any contractor who has ever considered specializing in curb and gutter work. END

Readers who would like to have additional information on the subject discussed in the foregoing article may request it by filling out one of the reader service cards in this issue.



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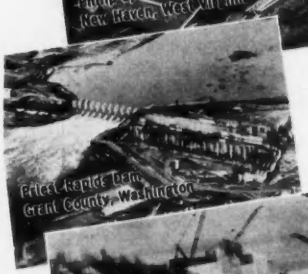

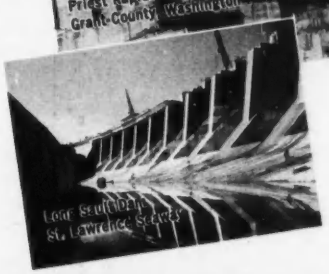

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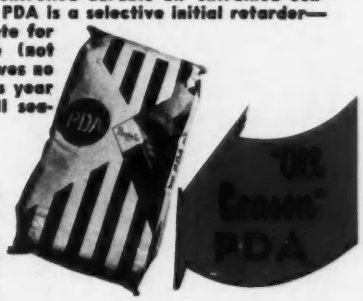

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PAST, PRESENT, AND FUTURE OF THE CONCRETE INDUSTRY

BY HERBERT K. COOK*

Here a well-known concrete technician reviews some of the background of this important material of construction, and offers some timely and pointed suggestions for expanding its use in the years ahead.

THE WRITER HAS NO INTENTION of sounding like a prophet of doom. Actually from his own personal experience over a period of 24 years in the concrete industry, he has every reason to believe that the field has a brilliant future. This opinion is supported by the vast amount of knowledge already available and the great amount of research and development work that is being done by such organizations as the American Concrete Institute, the American Society for Testing Materials, the National Crushed Stone Association, the National Sand and Gravel and National Ready Mixed Concrete Associations, and the Portland Cement Association, to mention a few and to say nothing about the many Federal organizations, private companies, and individuals working on concrete problems. Our greatest dangers are the possibilities of hindrance from shortsighted interests within our own ranks and above all the danger of our believing complacently that our product, having stood the test of time, cannot be improved.

The concrete industry could not have reached its present state without the use of portland cement. Yet even within the industry, to say nothing of the man on the street, the ignorance of many concerning the origin and use of this universally known material is truly astonishing. For example, how many times have you read a newspaper account of the dedication of a new *cement* bridge or the opening of a new *cement* highway? And how many times have you been asked which cement company makes "portland" brand cement?

Perhaps the phrase which annoys concrete men the most is the too frequently used expression "pouring cement." We all know, of course, that what is meant is "concrete" and not "cement," and that concrete should be "placed" and not "poured."

early history

The story of cement, cementing materials, and concrete goes back to the days of antiquity, even though portland cement concrete, as we know it today, dates back only about a century and a quarter. There is no way of knowing when the discovery of a cementing material was first made, but it must have happened soon after the first intelligent use of fire. One can imagine an early caveman building a fire in the center of some limestone or gypsum rocks. The heat calcines or dehydrates part of the rock, which crumbles and falls as a powder between the stones. A light rain, or water used in extinguishing the fire soaks into the powder and cements the pieces of rock together.

The earliest cementing materials about which we have any record are common lime and hydraulic lime. The cement employed by the early Egyp-

*The author is vice president in charge of engineering for the Master Builders Company, Cleveland. He was formerly chief of the concrete division, Waterways Experiment Station, Corps of Engineers, United States Army, Jackson, Mississippi. The views expressed here were originally presented in a speech before the Institute for Concrete Construction Contractors at Muncie, Indiana.

tians was a calcined impure gypsum. Calcined limestone was apparently not used purposefully until the Greek and Roman periods. They later developed pozzolanic cement by grinding together lime and a volcanic ash which was first found near Pozzuoli, Italy, in the vicinity of Mt. Vesuvius. This of course is the origin of the term "pozzolanic cement." This development was of great importance because this type of cement would harden under water whereas the earlier materials would not. Some structures built with this cement still stand today.

During the Middle Ages there was a general decline in the knowledge of cementing materials and a reversion to the use of lime mortars as in ancient times. It was not until the 15th and 16th centuries that signs of improvement again began to appear.

first portland cement

There is considerable controversy over who was the originator of portland cement. As with many manufactured materials, no single person can be given sole credit. In 1756 John Smeaton, an English engineer, was commissioned by Parliament to rebuild the Eddystone Lighthouse off the coast of Cornwall, England. He experimented, prior to construction of the lighthouse, with a number of limes and pozzolans, testing them in both salt and fresh water to disintegration. His important findings were that impure soft limestone, containing a proportion of clay materials, made the best hydraulic cement, and this type of cement was used in the lighthouse. Smeaton in his book on the construction of the lighthouse, published in 1796, stated: "I did not doubt but to make a cement that would equal the best merchantable Portland stone in solidity and durability." The reference is to a limestone quarried in the vicinity of Portland, England, and is the first reference to either the material or the name. His basic findings were rediscovered at least six times between 1756 and 1830.

Regardless of who should be given credit for what, the fact remains that Mr. Joseph Aspdin of Leeds, England, obtained a patent dated October 21, 1824, for a superior cement resembling Portland stone. A portion of the patent reads as follows:

"My method of making a cement or artificial stone for stucco-buildings, waterworks, cisterns, or any other purpose to which it may be applicable (and which I call Portland cement) is as follows . . ."

This is the first recorded reference to portland cement and the term is now used throughout the world to refer to the type of hydraulic cement commonly used in most concrete structures. It therefore describes a type of material, not a brand name.

While Aspdin's portland cement bore little resemblance to our present day material, it certainly was the origin of the name of the product which is of such great importance to the concrete industry.

The first plant for manufacturing portland cement in England was established by James Frost at Swanscombe in 1825. The first plants to be established outside of England were in Belgium and Germany about 1855. Importation to the United States began about 1865. The first cement produced in the United States was made by David O. Saylor in 1871 near Coplay, Pennsylvania. Before 1881 six plants were started in the United States. One of these was started in 1877 by Thomas Mitter of South Bend, Indiana. By 1890, seventeen plants were producing 330,000 barrels of cement per year. In 1957, the most recent year for which complete figures are available, over 284 million barrels of cement was produced in the United States.

why barrels and sacks?

This brings up an interesting and somewhat confusing question. Why is cement production and use described in terms of barrels or sacks? In the United States a sack of cement weighs 94 pounds and a barrel is four sacks. The use of barrel measurement probably started years ago when the wooden barrel was the only available means of shipping a somewhat perishable commodity, and a package containing 376 pounds approached the maximum weight that could conveniently be handled. In 24 years in the industry the writer has never seen a barrel of cement, even for export shipment.

With the advent of modern packing facilities and the use of bags, it was logical to put the barrel of cement in four sacks. There was also some vague attempt to relate a bag of cement to a cubic foot. This was probably of some use in connection with volumetric batching, but a bag of cement by no means represents one cubic foot of solid volume. Furthermore, today only a very few plants batch concrete by volume. All modern plants batch materials by weight in pounds, and the great majority of them receive cement shipments in bulk. The use of such terms as barrels and sacks therefore seems to have little value in this day and age.

The only present-day justification for the term sack is that we customarily refer to a cubic yard of concrete as containing 5 sacks or 6 sacks or some other cement content. This is supposed to indicate in some degree the quality or strength of the concrete, but at best it is awkward to use and at worst it is misleading. It is awkward because in the design of a concrete mix the proportions of cement, and all other materials, are basically determined in pounds and are weighed in pounds. An extra operation is required to convert it to sacks and another operation is required to convert it back to pounds, if batch weights are being given to a plant or batchman. It becomes particularly awkward if the mix is sent to another country, because even in Canada a sack of cement weighs 87½ pounds, not 94, and in other countries other weights are used. It is misleading, because a sack of one type, brand or shipment of cement will not give identical results to any other.

In any event 284 million barrels of cement is over a billion sacks or more than 106 billion pounds, and that is a lot of cement no matter how you measure it. It should also be remembered that only about one-tenth of portland cement concrete is portland cement, although it is the most expensive ingredient. Considering these figures it is obvious that the concrete industry at present is a tremendous business.

While it is customary today to indicate the importance and size of the concrete industry in terms of barrels of cement produced per year, this is a somewhat inaccurate method at best. For example: the cost of a cubic yard of concrete in place varies widely without respect to cement content. A yard of concrete in place in a residential driveway, where forming and handling costs are nil, may be as low as $10.00 a yard. The cost of a yard of concrete in place in a complicated and critical form may easily exceed $200 a yard.

(MORE)

why concrete is important

The wide diversification of use and the adaptability of concrete make it the most versatile and attractive of all construction materials. Hand in hand with these advantages is the fact that it is the only construction material that is manufactured at the site of the construction project. This places a heavy responsibility on the producers of all of the ingredients, those concerned with proportioning and mixing the materials, those responsible for erection of forms and placement of reinforcing, and those who put the concrete in place and who finish and cure it. An error or carelessness in any of these operations can result in very expensive repairs.

some limitations

Concrete is used in structures ranging from the backyard do-it-yourself barbecue or patio to huge dams, jet-bomber fields, the vast highway building program, multi-storied buildings, and all types of projects in between these extremes.

Realizing its great value and its many applications, we must also keep in mind some of its limitations. The inevitable volume change of portland cement concrete is perhaps the greatest challenge today. Concrete has a low tensile strength causing it to crack easily when proper precautions are not taken to compensate for it. Perhaps the most spectacular solution to this problem is prestressed concrete, a technique in which the concrete is placed under initial compression which must be overcome before tensile stresses come into play. Obviously all concrete cannot be prestressed. An approach to the problem of volume change in normal concrete is to hold down water content as much as possible, and to maintain controlled placing temperatures. In interior mass concrete, where strength and durability are not of paramount importance, it is desirable to maintain as low cement content as possible. The use of water-reducing admixtures has given excellent performance in permitting significant reductions in water content without sacrificing workability.

Ordinary concrete is a relatively poor insulating material, particularly when wet. Lightweight aggregate may be used to provide better insulating values and to prevent condensation, where other design considerations will permit.

Ordinary concrete has poor resistance to freezing and thawing and deicing salts such as used on highway pavements. The development of air entrainment has very greatly improved the resistance of concrete to these sources of disintegration.

Normal portland cement has poor resistance to sodium and magnesium sulfates present in alkali soils. The use of Type V sulfate-resisting cement or even Type II cement will greatly increase the ability of concrete to withstand this action.

All of the above improvements are brought about only when the proper type of concrete is used and when it contains materials of good quality, properly proportioned. Even when all of these precautions are observed, concrete will not perform as expected if it is improperly placed and improperly cured.

When speaking of curing we should consider other necessary things besides keeping the concrete wet or spraying it with a curing compound. For example, in freezing temperatures the concrete should be kept from freezing. In hot summer temperatures with low humidities and drying winds, measures must be taken to reduce concrete temperatures, to provide additional moisture immediately, with fog sprays if necessary, the use of sun and wind screens, and other precautions too numerous to explore here, but which if not observed will contribute to plastic shrinkage cracks in pavements, floors and other flatwork. Frequently in the summer high concrete temperatures will cause rapid setting of concrete, causing serious finishing difficulties and failure to obtain designed loadings on such structures as cambered bridge decks. The use of a retarding admixture has been very successful in overcoming many of these problems.

much still to be learned

In spite of many of the improvements that have been made over the years, much remains to be learned about concrete and its constituents. For example, we by no means completely understand the chemistry of the cement hydration process, or the problem of alkali-aggregate reactivity, and there are of course many other apparent mysteries. On the other hand much progress has been made on how to deal with these problems. With respect to the future the writer has

confidence that the industry will come up with the needed information. What we have to fear for the future is that we will either be lulled into a false sense of security by our past outstanding performance and thus succumb to competition; or that in our selfish determination to blame our poor performances on the other fellow, we will fail to remain competitive.

Our colleagues from the cement industry will agree that if anything goes wrong with a load of concrete, the concrete producer in a great number of instances blames it on the cement. The cement producer blames it on the aggregate. The aggregate producer blames it on the finisher or placing foreman, and if the concrete contains an admixture, everybody blames it on the admixture producer. This is all perfectly natural human behavior, perhaps aggravated a little by the circumstance that concrete is the only construction material that is manufactured at the job site. When something goes wrong, it is usually not found out until 28 days later, by which time additional concrete has been placed on top of it or all around it and somebody has really got a bear by the tail. Eventually things settle down on the basis of some compromise; the concrete is either replaced, or more generally everybody agrees it will do no harm to leave it in provided it never happens again on that particular job.

The above is admittedly an exaggeration of what really happens, but the point is that while everybody concerned with the concrete is busy passing the buck, there is always the danger that the engineer, architect, or owner is deciding that his next job will be asphalt, steel, aluminum, or plastic.

concrete has no monopoly

This is no joke. About a year ago one of the magazines of the building industry carried an article entitled, "The Home of 196X!" There was not a pound of portland cement, concrete, mortar or any concrete products in any part of the house including the foundation.

At least two very large dams would normally have been built of concrete, but because of high cost the Federal government reluctantly decided to build them of earth fill. The keen competition between asphalt and concrete in highway and runway construction is well known to all of you. Keen competition is of course the backbone of the American way of life. However, we do not want to lose by default.

If we want the concrete industry to have a future, it is high time that all members of the industry join forces in the fight to raise standards of quality and workmanship. Everybody in the industry (the man in the gravel pit or stone quarry, the cement finisher and the man who sprays the water or curing compound on the finished concrete) should do everything possible to see that concrete is of good quality and is produced at the most economical prices. It is only in this way that we can maintain and expand our very promising place in the future of the construction industry.

education is needed

Perhaps some practical illustrations are in order as a means of indicating some of the things we should and should not do in the future. About three years ago the writer was in a large city in the west inspecting a variety of concrete jobs. On one warehouse floor the cement finisher was complaining that the concrete did not have enough sand in it. On looking at the concrete in the company of a representative of the ready mix supplier, it was obvious to both of us that the trouble with the concrete was that it was highly oversanded. The ready mix man however agreed with the finisher and said he would order the next load with more sand. The writer accompanied him to a telephone and heard him tell the dispatcher at the plant to take out 100 pounds of sand. When this load of concrete was received the finisher was entirely satisfied, and of course he was convinced that more sand was what the concrete needed. To be sure the concrete was improved, but what about the misconception the cement finisher must still have concerning what makes good concrete for flat work? One thing we need to concentrate on to insure our future is a vigorous educational program at all levels and all stages of concreting operations.

On another job, which happened to be residential driveways, the contractor was complaining about plastic shrinkage cracks. He had a number of ideas about their cause including undersanding of the mix, poor sand grading and use of an admixture. On inspecting this job it was found that the concrete

was being placed on finely divided sub-grade in the hot summer sun with absolutely no prewetting of the sub-grade. The dry powdery base course was sucking the water out of the concrete like a vacuum pump, and the hot sun and dry wind were evaporating the rest at a tremendous rate. When we finally convinced him that thorough soaking of the sub-grade was worthwhile, his troubles disappeared.

On another occasion in the midwest a ready mix operator was receiving numerous complaints on the finishing characteristics of his concrete. Because it contained our admixture we were called in to explain the cause of the difficulties. He was most cooperative and a number of large slabs were cast in the back of his plant. Slabs were made with concrete with and without the admixture and with varying proportions of sand. While some improvements were made, none of the slabs were really satisfactory from a finishing standpoint. When the slabs were troweled small pockets invariably appeared, marring the surface finish. A sieve analysis revealed a sharp peak on the grading curve between the 8 and 16 sieves. Furthermore these sizes were rather elongated manufactured grits. These grits would stand on end during troweling causing the objectionable pockmarks. On having this called to his attention the ready mix operator said he could do nothing about the grits and he expected us to do something with our admixture to correct the situation. Not being miracle men, and not having a miracle admixture, we of course could not do this.

This happened about two years ago. The writer had the fortunate and unusual experience of being in on the sequel to it about two months ago when some tests were being made for this same plant. Mention was made of the excellent finishing characteristics of the concrete in question, and on how much better it was than the concrete we had seen two years before.

The ready mix man, without batting an eye and with no reference to our earlier recommendations said, "Oh yes, that sand we had then was very poorly graded and we had to do something about it. We got rid of those excess grits and we have had no finishing difficulties since then!"

The above examples have been cited only to bring out the necessity for all of us to join forces and to cooperate

to do the best job we know how for the good of the industry. The cement finisher and the job foreman (not that they should be singled out for special treatment) should learn the fundamentals of their trade. I am pleased to note in this connection that a number of local cement finishers' unions are making a conscientious effort to impart this knowledge in their apprentice schools.

everyone can help

No good will be done the industry if the aggregate producer furnishes poorly graded aggregates or aggregates of poor quality. It will save him money in the long run to make the effort to produce a satisfactory material.

Observation of good concreting practices by the contractor is a necessity. It will help neither him nor the industry to permit sloppy workmanship and blame the poor results on the ready mix producer.

The ready mix producer will in the long run save himself considerable money and also provide proof of the quality of his concrete if he will set up an adequate system of concrete quality control.

The cement producer can do himself and the industry very material harm by urging unnecessarily high cement contents and discouraging the use of any material which might help to produce entirely adequate concrete with lower water and cement contents. The loss of one large dam or a few miles of highway represents a far greater loss in cement production than can possibly result from the use of an admixture or cement replacement material.

The admixture producer should promote the use of his material where it has real merit and should refrain from placing himself in the class of the old-time medicine man with a cure for any and all of the ills of concrete. In the writer's opinion the user of an admixture should assure himself that the material he intends to use will improve the properties of his concrete, that it is provided by a manufacturer with a reliable background of experience, and that it is used under properly qualified supervision.

Up to this point we have rapped everyone in the industry except the man who furnishes the water and there is an old saying that you can't fight City Hall. Anyway we all can agree that the less water the better. END

literature

Water reducing agent. Good concrete design demands an effective water reducer so that the least possible amount of water may be used to produce a given consistency. Placewel is a liquid concrete admixture developed specifically for this purpose. Bulletin CA-6A illustrates by graphs, tables and photographs comparisons in compressive and flexural strength, workability, shrinkage, durability and permeability in concrete made both with and without this additive. The product is available in two forms, one to be used where air entrainment is specified and the other to be used where no air entrainment is desired. Johns-Manville, Celite Division, 22 East 40th Street, New York 16, N. Y.

Use of vibrating screeds. A bulletin, 587, on how to use vibrating screeds covers the use of these screeds for striking off and vibrating small types of slabs, including concrete floors, short sections of highways, concrete bridge decks, airport aprons, precast slabs and sidewalks. Information on how to support rails for vibrating screeds, as well as complete procedures for screeding is included. Special applications are shown. Stow Manufacturing Company, 354 Shear Street, Binghamton, N. Y.

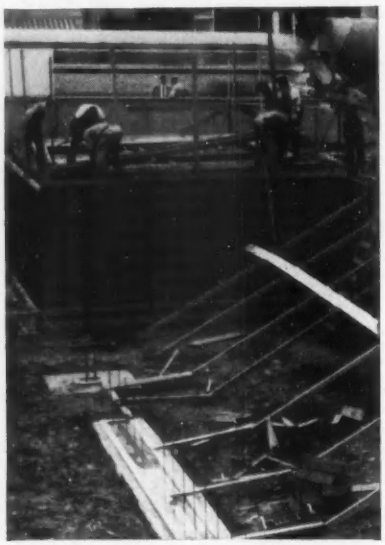
Wire rope storage. The service life of a wire rope can be substantially lengthened by following the suggestions for safe storage and proper lubrication contained in Leschen Service Bulletin No. 103. A wire rope is composed of moving parts which stretch, twist and turn to rub against each other and unless each wire is kept well lubricated abrasive wear is accelerated and the rope goes prematurely into the scrap heap, according to the bulletin. Leschen Wire Division, H. K. Porter Company, Inc., 2727 Hamilton Avenue, St. Louis 12, Mo.

Truck cost record book. For fleets and all truck operators, this edition of this manufacturer's cost record book is revised for modern fleet cost practices. Sales Promotion Department, The White Motor Company, Cleveland 1, Ohio.

Form ties. A folder states that Galva Twist forming utilizes the pressure of concrete to develop strength, speed and economy, making heavy backing and walers unnecessary for strength of panels. The waler serves only to align the wall. Step-by-step instructions accompanied by diagrams are given for setting up Galva Twist panels. Accurate, fast forming is assured for footings, walls, sidewalks and curbs. Jeffery Form Tie Company, Marengo, Ill.

Cold weather concreting. This subject is thoroughly covered in NRMCA publication No. 34, both in regard to the responsibility of the ready mixed concrete producer in furnishing suitable concrete and the responsibility of the contractor in taking proper protective measures after delivery. "Cold Weather Ready Mixed Concrete" is available from the National Ready Mixed Concrete Association, Munsey Building, Washington 4, D. C.

Commercial Forming

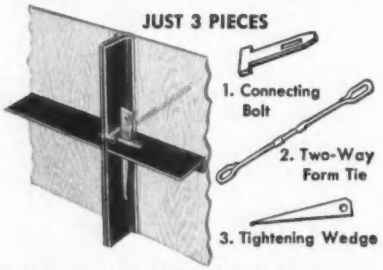


Symons Forms Help Contractor Speed Work on Bank Job

Used to Pour Foundation, Vaults & Retaining Walls

Designer and builder, Western Bank Contractors, Inc., Kansas City, Mo., used concrete to provide new look for banking in Kansas City. 4,000 square feet of Symons Steel-Ply Forms were used to speed construction of the foundation, vaults & retaining walls on this new $250,000 Community State Bank of Kansas City, Mo.

Initial cost of Symons Steel-Ply Forms is higher than Wood-Ply Forms, but this is more than offset by the



many reuses possible. Low-cost-per-use plus easier handling and stacking are reasons for the increasing demand.

Symons Steel-Ply Forms can be rented with purchase option. Steel-Ply Form Catalog FREE upon request.

Symons

SYMONS CLAMP & MFG. CO.

4271 Diversey Avenue, Dept. C-9
Chicago 39, Illinois

Circle #322 on reader card

literature

Placing and finishing equipment. An illustrated, easily read pocket catalog lists 21 different items of concrete placement equipment for use by contractors and local government maintenance of ways. Photographs and specifications are included. Catalogue WCG-1P is available from H. S. Watson Company, 1316-67th Street, Emeryville 8, Calif.

Conveyor. Bulletin 357 gives specifications and in-use pictures of the Faircrete conveyor. While it is especially designed for conveying concrete from transit mix truck to forms, it will also handle sand, gravel and bagged material and, with side guide rolls removed, slab materials. The Fairfield Engineering Company, 324 Barnhart Street, Marion, Ohio.

Electromagnetic vibrators. An illustrated, 12-page catalogue presents complete descriptions, data and specifications for 14 standard electromagnetic vibrators, ranging from models for vibrating less than one cubic foot of material to models capable of vibrating bins, hoppers and bunkers containing materials weighing in excess of 150 tons. Details concerning controllers, water-proof, dust-tight cases for vibrators, and explosion-proof cases for vibrators and controllers are also included. Syntron Company, 323 Lexington Avenue, Homer City, Penna.

Materials handling equipment. Lift trucks, industrial tractors, tractor shovels, scrapers and excavator cranes are among the types of equipment and parts illustrated in a 48-page booklet, PB-6. If you face the problem of "moving things" quickly and cheaply you will find this booklet of interest. Clark Equipment Company, Buchanan, Michigan.

Equipment leasing. A 20-page analysis of the advantages of equipment leasing, printed in color, contains extensive charts and statistical analyses of equipment leasing. Case histories are included. United States Leasing Corporation, 130 Montgomery Street, San Francisco 4, Calif.

Film on new highways. A 17-minute sound-color film is offered as a public service to increase the public's understanding of the planning behind the new highways now being built across the nation. It discusses the changes in America's population and how these changes are affecting land use and movement in urban, suburban and rural areas of the nation. Included along with some spectacular photography of highways are slum clearance projects and rural industrial developments. Portland Cement Association, 33 West Grand Avenue, Chicago 10, Ill.

Soil moisture meter. A bulletin on the Bouyoucos moisture meter explains what the meter is, how it works, and what it means to users. The basic purpose of the meter is to indicate rapidly and accurately the amount of moisture in a given section of soil. Such information is of interest to civil engineers, research groups and contractors. Soiltest, Inc., 4711 West North Avenue, Chicago 39, Ill.

Tamper. Bulletin No. A-269 describes a tamper, the latest addition of specially designed attachments for Bantam's line of ⅜ cubic yard power cranes and excavators. The attachment is said to offer 80 to 100 percent compaction at a maximum penetration of 3 feet. It may be used with any standard Bantam crane boom and is interchangeable with any of the Bantam's boom attachments. Schield Bantam Company, Waverly, Iowa.

Co-Reactants for epoxy resins. Technical bulletin 14A describes two co-reactants which not only cure epoxy resins at room temperature, but contribute many desirable properties to the blend. Genamid 250 and Genamid 310 are highly refined resinous amine adducts. When combined with epoxy resins, amine groups combine with epoxy groups to form an intricate 3-D cross-linked, polymerized molecule. These materials are liquid at room temperature and, when combined with liquid epoxy in half-gallon batches, have a usable pot life of 50 and 78 minutes respectively. Because of low viscosity and low exotherm, larger batches can be mixed and used conveniently. General Mills, Inc., Chemical Division, Box 191, Kankakee, Ill.

literature

Reinforcing bars. A brochure contains basic information concerning High Tensile Alloy Steel Stressrods and related accessories for use in prestressed concrete. The manufacturer states that these rods provide many advantages to the engineer and contractor for reasons of strength, limited number of tendons required, compactness, and simplicity of installation, stressing, anchoring, and final grouting. Rods Inc., 706 Folger Avenue, Berkeley 10, Calif.

Fir plywood. A new general information booklet, "Fir Plywood for Today's Construction," contains data on the physical properties of fir plywood, a chart of the characteristics and proper use of each grade of interior-type and exterior-type panel produced under Douglas Fir Plywood Association's quality-control program, a table of basic FHA requirements for plywood construction, and gluing and nailing recommendations. Douglas Fir Plywood Association, Tacoma 2, Wash.

Silicone products. The 1959 reference guide to Dow Corning silicone products describes what silicones can best meet the needs of an unbelievable variety of problems ranging from adhesives to release agents, resins to rubbers, dielectrics to water repellents. It contains graphic examples showing where many Dow Corning silicone products are currently being used, and it gives information on how to get specific data on the Dow Corning silicone material best suited to any application. The guide is indexed for easy reference. Dow Corning Corporation, Midland, Mich.

Decorative coating. A 4-page illustrated brochure outlines the properties and advantages of Hydrocide Colorcoat, a heavy-bodied, textured, decorative, weather resistant coating for exterior masonry walls above grade. It also describes how the material can be used for interior masonry surfaces above grade on new as well as existing buildings. Color chips show the ten colors available, and indicate the kind of texture which is obtained through use of the product. Detailed application, specification, and coverage data are designed to provide the architect, engineer, or contractor with all the information needed to select and apply the material. L. Sonneborn Sons, Inc., Building Products Division, 404 Fourth Avenue, New York 16, N. Y.

Finishes. A folder describes a swimming pool finish, an exterior stucco, a stucco paint, an interior masonry finish, and an acoustic plaster. Color chips show colors available. Information on preparing surfaces, mixing, applying and finishing are included for each of the five products. Highland Stucco & Lime Products, Inc., 15148 Oxnard Street, Van Nuys, Calif.

Watertight concrete. A 6-page folder, "Design and Specification of Watertight Concrete" summarizes authoritative thought on this subject and covers the basic requirements for watertight concrete. The role of Pozzolith in reducing permeability, shrinkage, bleeding and segregation to produce strong, durable structural concrete that is highly resistant to penetration of water under normal conditions is explained. The Master Builders Company, 7016 Euclid Avenue, Cleveland 3, Ohio.

equipment tools and materials

vibrator package for prestressing

A portable package vibrator control system for the prestressed concrete industry consists of ten Cleveland RC-30 portable electric vibrators, with mounting brackets, and a portable mounted control panel center for all vibrator control. All ten vibrators are plugged into the portable control panel, which is supplied by an outside power line. The individual vibrators, which are secured to the form with two bolts, can be mounted and unmounted in minutes, and shifted from form to form rapidly and easily. The Cleveland Vibrator Company, 2828 Clinton Avenue, Cleveland 13, Ohio.

portable belt conveyor

The Con-Vay-It "T" or troughed belt conveyor has been designed to handle earth, sand, gravel, rubble, etc. This unit is said to be excellent for small tunnel work, basement excavating, truck loading and unloading and stock piling. Small boom cross-sectional area permits passage through restricted openings. Standard power mounting is at the conveyor foot end for weight balance; however, head end power is available. Standard lengths of 20, 30 and 40 feet with electric motor or gasoline engine power provide flexibility of application. American Conveyor Company, 2133-37 South Christiana Avenue, Chicago 23, Illinois.

trench forms

This new type of trench form pictured in use in a housing development west of Chicago comes in 8-foot sections 12 inches high. The trench is poured 42 inches deep. It usually takes 10 man hours to set up the forms, 1½ man hours to pour and only 3 man hours to strip and move the forms on foundations which vary in size from 33 by 49 feet to 29 by 57 feet. Five foundations are being trenched and capped daily. Symons Clamp & Manufacturing Company, 4249 West Diversey Avenue, Chicago 40, Ill.

equipment and tools

steel stakes

Twelve nail holes drilled in a spiral arrangement provide 24 nail entry points in this steel stake. It can be nailed solidly to the form board regardless of rotation while being driven into the ground. The holes act as a support for the nails, leaving hands free for final adjustment and nailing. Dee Concrete Products Company, 670 North Michigan Avenue, Chicago 11, Ill.

welded wire fabric

The wire fabric pictured here will be used in foot-thick concrete slabs to be overlaid on present runways at the Kinross, Michigan Air Force Base. It consists of ½-inch diameter wires electrically welded in criss-cross fashion. This large wire fabric was chosen to provide the stronger and longer landing strips required for heavier, faster aircraft. United States Steel Corporation, Rockefeller Building, Cleveland 13, Ohio.

re-designed power float

The re-designed Kelley compactor power float is larger, more powerful, easier to operate, and may be set for any of four degrees of compaction. It is used for compaction-floating of concrete floors, for keying-in touch surface hardener materials, and for bonding dry-tamp topping to base slabs. Attachments for converting to a floor surface grinder are available. Kelley Machine Division, 285 Hinman Avenue, Buffalo 23, N. Y.

slab insulation

There is no reason to delay concrete slab or deck work because of winter weather. Even in sub-zero temperatures Cell-U-Mat makes it possible to maintain proper curing temperatures. The blanket consists of an efficient cellulose insulating mat completely encased in 4 mil polyethylene liners with edges heat sealed and ends tape sealed. It is simply rolled out over the screeded or troweled concrete. The insulating blanket enables uniform concrete surface temperatures to be maintained and the polyethylene liners provide good curing conditions by retaining the moisture in the slab. Write Wood Conversion Company, First National Bank Building, Saint Paul 1, Minn.

parting compounds

Two new all-weather parting compounds for reinforced and prestressed concrete forms are available from the manufacturer on a trial order basis in 5-gallon quantities at drum price. Speed and ease of parting and smoother surfaces with fewer bubbles in all kinds of weather are claimed as the outstanding advantages provided by these compounds. They can be applied by spray, brush or wiping methods. Parting Oil 833 is a solvent-type material designed for quick-drying and Parting Oil 842 is an economical, oil-type compound. Both contain anti-rust additives. Write Swift & Company, Technical Products Plant, 1800-165th Street, Hammond, Ind.

hydraulic rams

A line of hydraulic center-hole rams, in capacities of 30 to 300 tons, provides long strokes—up to 36 inches in some models. The manufacturer claims that the center hole design of the rams makes it possible to tension prestressing cables and rods directly with practically no internal friction. Connected with hydraulic pumps, they also serve as standard jacks for lifting or pushing loads and also to pull out and replace gears, wheels, propellers, bushing, cylinder liners, and shafts. Work is performed in any direction and even in congested areas because the need for bulky auxiliary rigging is completely eliminated. Write Star Jack Company, Inc., 2638 Davisson Street, River Grove, Ill.

soil anchor

Installation of a screw-type soil anchor requires only a few seconds and because of its soil compacting action offers extremely high load resistance to either tension or compression. It may be used to tie down tarpaulins or any other object that requires holding, either permanently or temporarily. Write Van Dyke Industries, 3625 Cahuenga Boulevard, Los Angeles 28, Calif.

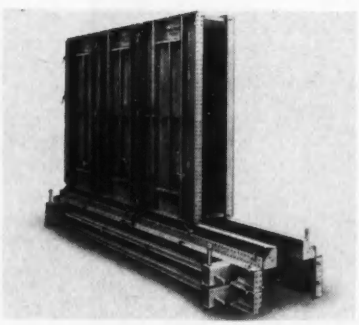
trailing wheel kit

A kit that converts the Essick VR-54 High-Frequency Vibrating Roller into a portable roller consists of two

wheels with pneumatic tires, two mounting brackets and two roll cradles. It is easily attached to the existing frame of the roller by drilling four holes on each side. The mounting brackets can be left permanently attached, or where close clearance is desired, they can be quickly removed. Once the brackets are attached, the cradles and wheels can be mounted in less than one minute, thereby converting the roller into a highway trailing unit without the use of any wrenches or tools. Write Essick Manufacturing Company, 1950 Santa Fe Avenue, Los Angeles 21, Calif.

trowels

The addition of new models to Cook's line of trowels now provides a size and model for every concrete finishing requirement, according to the manufacturer. All models feature a durable combination blade for both floating and finishing. Of special interest to the operator is the separate hydraulic system for blade adjustment. It operates independently of the Wisconsin air-cooled engine, and once set, the blades hold the set angle until the operator desires to make a change. Write Cook Brothers Equipment Company, 3334 San Fernando Road, Los Angeles 65, Calif.



wall footing forms

Footings and foundation walls may be poured at the same time with this wall footing and sidewalk form combined with regular Efco form equipment. Waiting for footings to harden before pouring walls is eliminated. The forms are also used for sidewalks or slab edges and as a base for wall forms where a footing has already been poured. Economy Forms Corporation, Box 128, Des Moines, Iowa.

books

Technical Societies Guide. *Published by I. P. A.-Technical Societies Committee, Room 1616, 41 East Forty-Second Street, New York 17, N. Y. 32 pp. $3.00.*

This reference manual of procedures required by technical societies and trade associations for preparation and presentation of papers has been compiled to serve as a reference for both the industrial publicist and engineer by giving specific procedures for formal presentations of technical papers and the preparation of associated publicity.

Prepared in cooperation with 36 leading technical societies, the guide contains data on membership structure, number of members, principal meeting dates, subjects of interest, paper requirements, mechanics of contribution, policies on pre-prints and reprints, restrictions and rights to papers, and data on each society's publication and publicity policy.

Included in a special section for authors are suggestions regarding the content of papers, fundamentals of oral presentation and preparation of visual aids as well as information on the preparation of the manuscript for submission to the editors of society publications.

Corrosion of Reinforcing Steel and Repair of Concrete in a Marine Environment. Bulletin 182. *Presented at the Thirty-Sixth Annual Meeting, January 7-11, 1957. Published by Highway Research Board, 2101 Constitution Avenue, Washington 25, D.C. 41 pp. Illus. $0.80.*

This bulletin comprises the two parts of a paper entitled "Causes and Repair of Deterioration to a California Bridge Due to Corrosion of Reinforcing Steel in a Marine Environment," as presented at the Thirty-Sixth Annual Meeting of the Highway Research Board.

Part I, by M. W. Gewertz, discusses the history, character and extent of the deterioration encountered in the San Mateo—Hayward Bridge; the inspection and estimating procedures prior to repair; repair procedures; the basis of contract payment; and the costs of repairs.

Part II, by Bailey Tremper, John L. Beaton, and R. F. Stratfull, discusses the fundamental factors causing corrosion of the reinforcing steel in this bridge, and points out that the spalling and rupture of the various members are primarily the result of pressures caused by the corrosion products. No evidence was found that stray currents had produced electrolysis.

Book of ASTM Standards. Part 4. Cement, Concrete, Mortars, Road Materials, Waterproofing, Soils. *Published by American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Penna. 1458 pp. $12.00.*

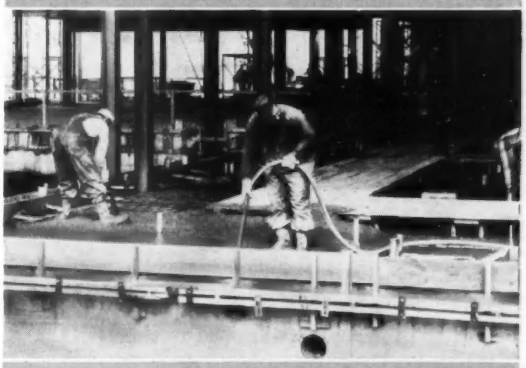
This book, one of ten being published to cover the production, purchase, and evaluation of a wide range of materials, gives specifications, definitions and testing methods for cement, lime, gypsum, magnesium oxychloride and oxysulfate cements, masonry mortar, chemical-resistant mortars, concrete aggregates, concrete, materials for curing concrete, bituminous road materials, non-bituminous road materials, soils, and bituminous materials for roofing and waterproofing.

Easier Placeability...

Earlier Stripping of Forms...

Better Finishing...with

POZZOLITH*



In the construction of this large, modern suburban department store, again were demonstrated the improved quality and cost benefits obtained with POZZOLITH.

Besides economically providing easier placeability and better finishing, POZZOLITH was an aid in obtaining high early strengths, which permitted earlier stripping of forms to speed completion of the project.

Call in any one of our more than 100 full-time field technical men to discuss these and other benefits of POZZOLITH for your project.

*POZZOLITH . . . registered trademark of The Master Builders Company for its water-reducing, air-entraining admixture for concrete.

"May's-on-the-Heights"—Suburban Department Store, Cleveland, Ohio
Architect: Victor Gruen Associates, Detroit, Michigan
Associate Architect: Jack Alan Bialosky, Cleveland
General Contractor: Sam W. Emerson Company, Cleveland

THE **MASTER BUILDERS** COMPANY
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Concretely Speaking . . .

WHAT THE EXPERTS SAY ABOUT DUSTING FLOORS

The cause and prevention of dusting concrete floors has received a lot of attention at one time or another from expert technicians, and we think you'll be interested in knowing some of the conclusions that invariably grow out of any study of this problem. The basic cause, of course, is the presence of weak concrete on the surface of the slab. Weak surface concrete powders readily under even light traffic, causing the condition we call dusting.

But why should we have weak concrete on the surface of a slab and not have it also beneath the surface? The answer is most frequently that the surface has been troweled excessively. When concrete is troweled excessively, and particularly when the troweling is done too soon, water and fines are worked to the surface, diluting the cement content of the concrete in the very area in which maximum strength is most essential. The resulting surface has little ability to resist wear.

So one self-evident preventive measure is to avoid excessive troweling. The steel trowel should be used as sparingly as possible to remove float marks, and final steel troweling should not be attempted until the surface of the concrete can be just dented with finger pressure. Remember that the small imperfections visible in fresh concrete generally do not show when the concrete is cured.

Of course there can be other factors involved in this problem. The hardest and most wear-resistant surfaces are produced with relatively dry mixes. Slump should not exceed 4 inches, and it should be even less if vibration is to be used. Thorough curing is also essential, since a poorly cured slab will dry out first on the surface, thus halting the hydration of the cement precisely where maximum hardening is most important!

Floors placed in cold weather, with protection from freezing by means of unvented heaters, may show dusting due to surface carbonation of the concrete caused by carbon dioxide released by the heaters. The obvious preventive for this cause of dusting is to exhaust combustion gases to the outside, or to use some type of membrane curing agent if unvented heaters must be used.

According to the experts, these simple precautions will prevent concrete floors from dusting. We're sure you'll agree that it isn't much of a price to pay to get rid of a problem that reflects so poorly on both your efforts and ours.

YOUR LOCAL PRODUCER OF READY-MIXED CONCRETE